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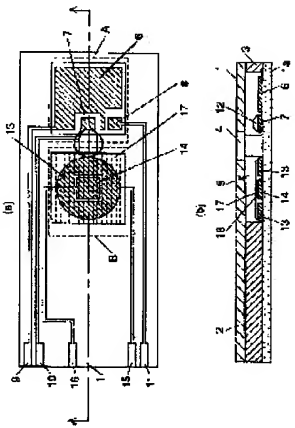
(54) MEASUREMENT ELECTRODE, MEASUREMENT DEVICE AND METHOD OF DETERMINING FOR ULCERATIVE COLITIS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a measurement electrode for an ulcerative colitis for determining it rapidly, simply and precisely without examining blood by an expert.
SOLUTION: This measurement electrode of the ulcerative colitis is equipped with a total fatty acid detection part formed on a substrate and a lactic acid detection part. The total fatty acid detection part has a first working electrode, a first counter electrode and a reference electrode. A proton attack layer is fixed on a surface of the first working electrode. The first electrode pairs with the first working electrode. The reference electrode has a reference potential. The lactic acid detection part has a second working electrode, a second counter electrode and reactive layer. The second counter electrode pairs with the second working electrode. The reactive layers are provided on surfaces of the second working electrode and the second counter electrode, and include an enzyme which can oxidize the lactic acid. Buffer layers, which separate the lactic acid detection part from the total fatty acid detection part, are provided on surfaces of the reactive layers.



JAPANESE [JP,2001-318071,A]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the ulcerousness large intestine disease measuring electrode for discovering an ulcerousness large intestine disease including colon cancer, the ulcerousness large intestine disease measuring device which uses this, and the ulcerousness large intestine disease judging method of discovering this ulcerousness large intestine disease further.
[0002]
[Description of the Prior Art]These days, the illnesses most feared all over the world are a malignant tumor and cancer. Even if the symptoms of cancer is shown, since there is no subjective sign not much and it goes on, it is easy to become too late in an initial stage. Condition hardly appears until colon cancer is more serious than gastric cancer, an esophagus cancer, duodenal cancer, etc. and bleeding takes place during defecation especially. and when this bleeding

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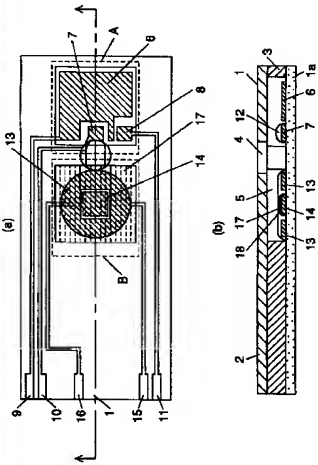

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takes place, and having already progressed fairly usually comes out, colon cancer has it and it is discovered at this time, as compared with the case where early detection is made, treatment will also be restricted considerably in many cases. Even if this point and this are benign ulcerousness large intestine diseases, it is the same, and when bleeding takes place, usually condition of disease has reached an advanced stage considerably. It may happen that that it is out of order moreover has such hemorrhagic defecation colon cancer or not only an ulcerative large intestine disease but chronic diseases, such as a hemorrhoids wax. From such a situation, in our country with many hemorrhoids wax patients, the opportunity of the therapy was lost in many cases because the patient itself considers the chance of discovery, such as special colon cancer, easily. therefore, development of the method that distinction with a mere hemorrhoids wax and diseases, such as colon cancer, can be judged simply and correctly when development of the method of carrying out early detection of the ulcerousness large intestine diseases, such as colon cancer, and bleeding are, before bleeding took place -- further -- therefore, development of the ulcerousness large intestine disease measuring device to be used was desired.

[0003]By the way, cancer and a benign polyp are the same at the point which a cell increases by cell division. However, malignant tumors, such as cancer, are indefinitely increased to benign cell division being restrictively performed in the required range. Since the normal cell only caused the transformation because a gene gets damaged, many of this malignant tumor are also difficult for distinguishing the cell of cellular structure top malignancy from a benign cell. Although it is possible for the cell which cancerated when the gene level analyzed, and a normal cell to judge the cellular structure which extracted, the large-scale analysis apparatus which analyzes a gene, and comparatively prolonged analysis are required, and the simple judgment method that the patient itself can be performed daily cannot become. Even if spread cannot be expected and there is hemorrhagic defecation if it is not an easy and cheap device in order to perform early detection, As for an ulcerousness large intestine disease measuring device, a meaning will not be made if it is not a device with which the patient itself can judge correctly bleeding by a hemorrhoids wax, and bleeding by ulcer diseases, such as colon cancer, easily.

[0004]Conventionally, as a method of inspecting colon cancer etc., the occult blood ingredient (hemoglobin) under defecation is extracted with a feces sampling implement,

and the method of measuring with an immunological measuring method using an anti-hemoglobin antibody is performed. However, although this inspection method was easy, in order to make hemoglobin under defecation into a stool test sample and to carry out long term storage, hemoglobin in a sample decomposed during preservation and there was a problem that hemoglobin could not measure correctly. In order to control decomposition of hemoglobin, the method (JP,7-72154,A) of adding and carrying out penicillin and a non-penicillin antibiotic, etc. are indicated, but as for the point of spending a long time on measurement, how is unavoidable, and the accuracy of a measurement result cannot be expected. And even if it can measure existence of hemoglobin, it cannot distinguish whether it is bleeding according whether it is bleeding by a hemorrhoids wax to colon cancer etc. In short, this immunological measuring method judges whether human blood exists whether human blood only exists during defecation.

[0005]Thus, according to the cellular structure inspection of a gene level, exact judgment can be performed, but a specialist's knowledge and a special analysis apparatus are required, and it is cheap, and far from the inspection method which the patient itself measures simple. Although the immunological measuring method which sees the existence of bleeding by the stool test by a feces sampling implement is easy, distinction with the disease which there is a problem in accuracy, in addition requires urgency, such as colon cancer and an ulcer, and chronic diseases, such as everyday hemorrhoids, does not attach it at all. A specialist is required after all to perform immunological determination moreover, the patient itself cannot judge, and another close examination is correctly [fundamental again] needed. From such a reason, it is based on neither a gene analysis nor blood, but creation of a completely new inspection method which discovers what an ulcer was able to carry out in the large intestine is desired.

[0006]By the way, the following reports are made about the ulcerousness large intestine disease about short chain fatty acid which is a patient's bacteria in facilities and metabolite (the 193-198th Japanese Society of Gastroenterology magazine [79th volume / No. 2] page). This short chain fatty acid is metabolite of sugar by enterobacilli, and it is carboxylic acid to the carbon numbers 6, such as acetic acid, propionic acid, butanoic acid, valeryl acid, and lactic acid.

[0007]According to this report, an ulcerousness large intestine disease patient's bacterial count in facilities decreases compared with a healthy person. Especially, the

number of anaerobic bacteria decreases and the number of aerobes increases. As a result, compared with a healthy person, the short-chain-fatty-acid concentration which is metabolite decreases in the form proportional to the bacterial count in facilities, and it is reported that the lactic acid concentration which is non-volatile short chain fatty acid becomes high. It is reported that lactic acid concentration increases, so that a lesion is expanded, and, so that it hits from the remission at an active term.

[0008]Thus, short chain fatty acid increases in number, by a healthy person, an ulcerousness large intestine disease has a close relation to short chain fatty acid and lactic acid which are contained in facilities, since there is little lactic acid, the ratio of (lactic acid concentration / short-chain-fatty-acid concentration) takes a small value, but. In an ulcerousness large intestine disease patient's facilities, since [with little short chain fatty acid] there is much lactic acid, as for the ratio of (lactic acid concentration / short-chain-fatty-acid concentration), it turns out that a big value is taken relatively. Therefore, if the amount of lactic acid and short chain fatty acid or a ratio can be measured simply and correctly, a completely different ulcerousness large intestine disease measuring device from a Prior art can be obtained.

[0009]In order to realize this ulcerousness large intestine disease measuring device, how lactic acid and short chain fatty acid are measured poses a problem. This invention persons proposed the measuring device using a voltammetry, in order to already measure the acidity of organic acid, such as fatty acid, moreover simply for a short time (JP,10-288599,A). This mixes a p-benzoquinone derivative or o-benzoquinone derivative with an organic solvent to a supporting electrolyte, puts a test portion into this, makes a coexistent electrolytic solution, and measures acidity electrochemically. A p-benzoquinone derivative or o-benzoquinone derivative is a proton attack substance.

The substance which has the operation which draws out the proton which does not reach for saying but is contained in acid in the state where it does not dissociate is combined with the proton which dissociated.

Energizing to the work electrode which immersed in the coexistent electrolytic solution, and a counter electrode and the reference electrode in which the potential of a standard is shown further, by impressing the voltage by the side of minus to a work electrode from rest potential on the basis of the potential of a reference electrode, a proton attack substance is anion-ized itself and draws out the proton in acid. Although there are a quinone compound and an azo

compound in a proton attack substance, A p-benzoquinone derivative or o-benzoquinone derivative has the outstanding feature that it can measure even if it does not ******, since reduction potential has shifted from a point of the standup of the current of the voltamogram of dissolved oxygen while it is excellent in light stability. Therefore, it is a plus side rather than p-BENZOKIN derivative or o-BENZOKIN derivative is returned and reduction current shows this peak, when the potential impressed to a work electrode is swept on the basis of the potential of a reference electrode, without making the troublesome preparations for measurement, Those derivatives are returned by organic acid, such as fatty acid, with each reduction potential, and a voltamogram top pre peak is shown with it. When reduction potential of fatty acid is near, the reduction current which shows a pre peak has the character to be proportional to the amount of total fatty acid, i.e., the quantity of acid, with this reduction potential.

[0010]The conventional proposal also of the lactic-acid-measurement electrode for measuring lactic acid electrochemically is made (JP,7-92138,A). On a substrate, this lactic-acid-measurement electrode prints conductive carbon paste, and forms a working pole and a counter electrode. It has composition which mixed the lactic acid racemase with lactic acid oxidase, and formed the reaction layer on this electrode. Lactic acid oxidase is an enzyme which oxidizes lactic acid, and a lactic acid racemase is an enzyme for carrying out racemization of the lactic acid. It oxidizes by carrying out racemization of the D-lactic acid which does not oxidize with lactic acid oxidase, either to L-lactic acid, oxidizing the L-lactic-acid-ized lactic acid with lactic acid oxidase, generating hyperoxidation oxygen, and impressing voltage for this hyperoxidation oxygen between a working pole and a counter electrode by this lactic acid racemase. FERI cyanide ion can also be used as an electron carrier.

[0011]Thus, if the ratio of lactic acid and short chain fatty acid is known simply and correctly, a completely different ulcerousness large intestine disease measuring device from a Prior art and the ulcerousness large intestine disease measuring electrode for it can be obtained, but if fatty acid and lactic acid are merely measured, an error arises.

[0012]

[Problem(s) to be Solved by the Invention]As explained above, the method of extracting the occult blood ingredient (hemoglobin) under defecation with a feces sampling implement, and measuring with the immunological

measuring method using an anti-hemoglobin antibody is easy, but. In order to carry out long term storage of the hemoglobin under defecation, hemoglobin in a sample decomposed during preservation and there was a problem that hemoglobin could not measure correctly. And even if it uses the method of adding and carrying out penicillin and a non-penicillin antibiotic, measurement does not become exact like important point sushi and it about a long time for measurement. And even if it can measure existence of hemoglobin, it cannot distinguish whether it is bleeding according whether it is bleeding by a hemorrhoids wax to colon cancer, an ulcer, etc.

[0013]Although the measuring device of the former which measures with a voltammetry the sample solution which mixed the proton attack substance for the acidity of organic acid, and the electrode for that measurement can measure the total amount concentration of organic acid electrochemically, in case of this method, measurement of only lactic acid is difficult and a fixed quantity of lactic acid is not made substantially. Then, if it is going to quantify lactic acid separately, lactic acid will be specifically oxidized with enzymes, such as lactic acid oxidase, like a Prior art, If hyperoxidation oxygen was generated, it did not measure and it was ****, there was nothing, but in order to generate pyruvic acid simultaneously by this enzyme reaction, there was a problem of putting measurement of the concentration of total fatty acid by a voltammetry out of order with the difference of the reduction potential of pyruvic acid and lactic acid. It was fundamentally the same even when an electron carrier was used.

[0014]Then, it aims at providing a short time and the ulcerousness large intestine disease measuring electrode for judging simply and correctly, without this invention's solving such a conventional problem and inspecting blood by a specialist.

[0015]An object [without inspecting blood by a specialist] of this invention is to provide a short time and the ulcerousness large intestine disease measuring device which can be judged simply and correctly.

[0016]An object [without inspecting blood by a specialist] of this invention is to provide a short time and the ulcerousness large intestine disease judging method which can be judged simply and correctly.

[0017]

[Means for Solving the Problem]This invention is characterized by an ulcerousness large intestine disease measuring electrode comprising the following, in order to

solve an aforementioned problem.
The 1st work electrode in which it is the ulcerousness large intestine disease measuring electrode provided with a total-fatty-acid primary detecting element formed on a pedestal, and a lactic acid primary detecting element, and a proton attack layer was fixed for said total-fatty-acid primary detecting element by the surface.
Said 1st work electrode and the 1st counter electrode that makes a pair.
It has a reference electrode in which potential of a standard is shown, and said lactic acid primary detecting element is the 2nd work electrode.
A buffer layer which is provided in the surface of said 2nd work electrode, the 2nd counter electrode that makes a pair, and said 2nd work electrode and said 2nd counter electrode, has the reaction layer having contained an enzyme which can oxidize lactic acid, and separates lactic acid detection from total-fatty-acid detection in the surface of said reaction layer.

[0018]without this inspects blood by a specialist -- a short time -- and it can judge simply and correctly.
[0019]The 1st power supply that impresses voltage between said 1st work electrode and said 1st counter electrode when an ulcerousness large intestine disease measuring device of this invention is provided with an ulcerousness large intestine disease measuring electrode indicated above and a sample solution under test is dropped at said ulcerousness large intestine disease measuring electrode, A control section which controls potential between said 2nd work electrode and said counter electrode to predetermined potential while having the 2nd power supply that impresses voltage between said 2nd work electrode and said counter electrode and sweeping potential between said 1st work electrode and said reference electrode, The 1st detection part that detects current which flows between said 1st work electrode and said 1st counter electrode, It has the 2nd detection part that detects current which flows between said 2nd work electrode and said 2nd counter electrode, and had operation part which computes a ratio of the amount of lactic acid to the amount of total fatty acid with a current value detected by said 1st detection part and said 2nd detection part.
[0020]Thereby, a short time and an ulcerousness large intestine disease measuring electrode which can be judged simply and correctly can be provided, without inspecting blood by a specialist.

[0021]An ulcerousness large intestine disease judging method of this invention, While sweeping potential of the 1st work electrode that trickled a sample solution under test and in which a proton attack layer was fixed on the basis of potential of a reference electrode, Measure reduction current which flows between said work electrode and the 1st counter electrode, and make a reaction layer having contained an enzyme in which lactic acid subsequently oxidizes said sample solution under test permeate, impress predetermined voltage between the 2nd work electrode and the 2nd counter electrode, and oxidation current is measured, It judges with an ulcerousness large intestine disease from relation between said reduction current and said oxidation current.

[0022]Thereby, a short time and an ulcerousness large intestine disease judging method which can be judged simply and correctly can be provided, without inspecting blood by a specialist.

[0023]

[Embodiment of the Invention]The 1st work electrode in which the invention indicated to claim 1 is the ulcerousness large intestine disease measuring electrode provided with the total-fatty-acid primary detecting element formed on the pedestal, and the lactic acid primary detecting element, and the proton attack layer was fixed for said total-fatty-acid primary detecting element by the surface, Have said 1st work electrode, the 1st counter electrode that makes a pair, and a reference electrode in which the potential of a standard is shown, and said lactic acid primary detecting element The 2nd work electrode, It is provided in the surface of said 2nd work electrode, the 2nd counter electrode that makes a pair, and said 2nd work electrode and said 2nd counter electrode, Since it is an ulcerousness large intestine disease measuring electrode, wherein it has the reaction layer having contained the enzyme which can oxidize lactic acid and the buffer layer which separates lactic acid detection from total-fatty-acid detection is provided in the surface of said reaction layer, After carrying out deprotonate by a proton attack substance and measuring total-fatty-acid concentration electrochemically by impressing voltage to a total-fatty-acid primary detecting element and a lactic acid primary detecting element, respectively, it is separated by the buffer layer and the lactic acid concentration generated in the enzyme reaction in the reaction layer which was overdue and permeated can be measured.

[0024]Since it is the ulcerousness large intestine disease

measuring electrode according to claim 1 in which the enzyme which can carry out racemization of the lactic acid to said reaction layer is contained, even if the enzyme which can oxidize lactic acid specifically is only L-lactic acid, the invention indicated to claim 2 carries out racemization of the D-lactic acid, and can measure the total amount concentration of lactic acid correctly.

[0025]Since the invention indicated to claim 3 is the ulcerousness large intestine disease measuring electrode according to any one of claims 1 to 2, wherein said proton attack substance is a quinone compound or an azo compound, it is hard to dissolve blood and the immobilization to an electrode is easy for it.

[0026]Since the invention indicated to claim 4 is the ulcerousness large intestine disease measuring electrode according to claim 3 in which said quinone compound is characterized by being an mercapto quinone compound, fixed power becomes strong.

[0027]Since the invention indicated to claim 5 is the ulcerousness large intestine disease measuring electrode according to any one of claims 1 to 4, wherein said pedestal is a substrate, it is compact and easy to carry.

[0028]The invention indicated to claim 6 Said 1st work electrode, said 1st counter electrode, a reference electrode, both said 2nd work electrode and said 2nd counter electrode -- although -- since it is the ulcerousness large intestine disease measuring electrode according to any one of claims 1 to 5 forming filmy, each electrode is flattened, it can do compactly thinly, and production is also easy.

[0029]The 1st power supply that impresses voltage between said 1st work electrode and said 1st counter electrode when the invention indicated to claim 7 is provided with the ulcerousness large intestine disease measuring electrode according to any one of claims 1 to 6 and a sample solution under test is dropped at said ulcerousness large intestine disease measuring electrode, The control section which controls the potential between said 2nd work electrode and said counter electrode to predetermined potential while having the 2nd power supply that impresses voltage between said 2nd work electrode and said counter electrode and sweeping the potential between said 1st work electrode and said reference electrode, The 1st detection part that detects the current which flows between said 1st work electrode and said 1st counter electrode, It has the 2nd detection part that detects the current which flows between said 2nd work electrode and said 2nd counter electrode, Since it is an ulcerousness large intestine disease measuring device

provided with the operation part which computes the ratio of lactic acid concentration to total-fatty-acid concentration with the current value detected by said 1st detection part and said 2nd detection part, While measuring total-fatty-acid concentration with a voltammetry in a total-fatty-acid primary detecting element, The concentration of the lactic acid generated in a reaction layer can be measured after measuring total-fatty-acid concentration in a lactic acid primary detecting element, and for the pyruvic acid by which it is generated in the case of lactic acid measurement, measurement of the total amount concentration of total fatty acid is not put out of order, and it can measure, Since the ratio of lactic acid concentration to total-fatty-acid concentration is computed, an ulcerousness large intestine disease can be judged correctly.

[0030]The 1st power supply that impresses voltage between said 1st work electrode and said 1st counter electrode when the invention indicated to claim 8 is provided with the ulcerousness large intestine disease measuring electrode according to any one of claims 1 to 6 and a sample solution under test is dropped at said ulcerousness large intestine disease measuring electrode, It has the 2nd power supply that impresses voltage between said 2nd work electrode and said counter electrode, The control section which controls the potential between said 2nd work electrode and said 2nd counter electrode to the 2nd predetermined potential while controlling between said 1st work electrode and said 1st counter electrode to the 1st predetermined potential on the basis of said reference electrode, The 1st detection part that detects the current which flows between said 1st work electrode and said 1st counter electrode, It has the 2nd detection part that detects the current which flows between said 2nd work electrode and said 2nd counter electrode, Since it is an ulcerousness large intestine disease measuring device provided with the operation part which computes the ratio of lactic acid concentration to total-fatty-acid concentration with the current value detected by said 1st detection part and said 2nd detection part, While measuring total-fatty-acid concentration by chronoamperometry in a total-fatty-acid primary detecting element, The lactic acid generated in a reaction layer can be measured after measuring total-fatty-acid concentration in a lactic acid primary detecting element, and for the pyruvic acid by which it is generated in the case of lactic acid measurement, measurement of the total amount concentration of total fatty acid is not put out of order, and it can measure, Since the ratio of lactic acid concentration to total-fatty-acid

concentration is computed, an ulcerousness large intestine disease can be judged correctly.

[0031]While sweeping the potential of the 1st work electrode in which the invention indicated to claim 9 trickled the sample solution under test, and the proton attack layer was fixed on the basis of the potential of a reference electrode, Measure the reduction current which flows between said work electrode and the 1st counter electrode, and make the reaction layer having contained the enzyme in which lactic acid subsequently oxidizes said sample solution under test permeate, impress predetermined voltage between the 2nd work electrode and the 2nd counter electrode, and oxidation current is measured, Since it is the ulcerousness large intestine disease judging method judging with an ulcerousness large intestine disease from the relation between said reduction current and said oxidation current, and the enzyme reaction of the lactic acid is carried out and total-fatty-acid concentration is selectively measured after measurement with a voltammetry, The concentration of total fatty acid is not out of order with the pyruvic acid by which it is generated in the case of lactic acid density measurement.

[0032]While sweeping the potential of the 1st work electrode in which the invention indicated to claim 10 trickled the sample solution under test, and the proton attack layer was fixed on the basis of the potential of a reference electrode, Measure the reduction current which flows between said work electrode and the 1st counter electrode, and make the reaction layer having contained the enzyme in which lactic acid subsequently oxidizes said sample solution under test permeate, impress predetermined voltage between the 2nd work electrode and the 2nd counter electrode, and oxidation current is measured, Since it is the ulcerousness large intestine disease judging method judging with an ulcerousness large intestine disease from the relation between said reduction current and said oxidation current, and the enzyme reaction of the lactic acid is carried out and total fatty acid is selectively measured after measurement by chronoamperometry, The concentration of total fatty acid is not out of order with the pyruvic acid by which it is generated in the case of lactic acid density measurement.

[0033]Hereafter, the 1 embodiment of this invention is described, referring to drawings.

[0034](Embodiment 1) The entire configuration figure of an ulcerousness large intestine disease measuring electrode [in / in drawing 1 (a) / the embodiment of the invention 1], The sectional view of an ulcerousness large intestine disease

measuring electrode [in / in drawing 1 (b) / the embodiment of the invention 1], The covering front view which disassembled the ulcerousness large intestine disease measuring electrode [in / in drawing 2 (a) / the embodiment of the invention 1], The spacer front view and drawing 2 (c) into which drawing 2 (b) disassembled the ulcerousness large intestine disease measuring electrode in the embodiment of the invention 1 are the substrate front view which disassembled the ulcerousness large intestine disease measuring electrode in the embodiment of the invention 1.

[0035]The ulcerousness large intestine disease measuring electrode for 1 trickling a sample solution and measuring total fatty acid and lactic acid electrochemically in drawing 1 and drawing 2. The substrate of (the following, a measuring electrode), and the measuring electrode 1 in which 1a consists of insulating materials, such as polyethylene terephthalate, Covering of the perforated plate which can pour into the measuring electrode 1 the sample solution in which 2 was dropped from the upper part with the wrap in the substrate 1a, and 3 are the monotonous spacers with which the opening which is pinched between the substrate 1a and the covering 2, and becomes eye a liquid pool was formed. Also as for the covering 2 and the spacer 3, forming with polyethylene terephthalate is preferred. Although the substrate 1a is adopted in this Embodiment 1 as a pedestal which carries an electrode, as long as it is an insulating material which can hold an electrode, it may be what kind of thing. It is a sample injected hole which 4 is formed in the covering 2 and distributes a sample to the both sides of the total-fatty-acid primary detecting element A and the lactic acid primary detecting element B, and 5 is an opening for sample holding chamber formation which consists of two liquid pool openings connected to the communicating grooves and this which were located directly under the sample injected hole 5 of the covering 2. Here, a sample solution mixes an electrolyte with an organic solvent, and produces the facilities extracted from defecation. As an organic solvent, ethanol, isopropyl alcohol, etc. are desirable, and sodium chloride, potassium chloride, lithium chloride of an electrolyte, etc. are desirable. It is appropriate to dissolve in an organic solvent so that the facilities used as a sample may be 20 g/L - 100 g/L, to carry out 50 mg/L-150 mg/L mixing of the electrolyte, and to produce a sample solution.

[0036]First, the total-fatty-acid primary detecting element A of the measuring electrode 1 is explained. Since 6

constitutes the total-fatty-acid primary detecting element A, the 1st counter electrode, similarly, 7 is the 1st work electrode and 8 is a reference electrode. It is formed in rectangular shape in this Embodiment 1, the 1st counter electrode 9 puts prescribed clearance on mosaic shape, and accommodates these two in a crevice, and the 1st work electrode 7 and the reference electrode 8 are together put so that it may become approximately rectangular shape as a whole.

[0037]9 is the pattern for the 1st counter electrode which printed thinly the energization nature carbon paste which made the substrate 1a contain a resin binder by screen-stencil to band-like, in order to thin-film-ize the total-fatty-acid primary detecting element A and to form it. Similarly the pattern for the 1st work electrode which 10 similarly printed energization nature carbon paste to band-like thinly for total-fatty-acid primary detecting element A formation, and was formed, and 11 are the patterns for reference electrodes. 12 is a proton attack layer for drawing out a proton from fatty acid of a sample, returning with the 1st work electrode 7, and forming the pre peak of fatty acid.

[0038]Although the 1st counter electrode 6 comprises platinum, black lead, gold, stainless steel, aluminum, and other conductive materials and it is connected with the above-mentioned 1st counter electrode pattern 9, What is not constituted from the 1st counter electrode pattern 9 and another material, but is really formed with energization nature carbon paste together with the pattern 9 for the 1st counter electrode may be sufficient. Next, the carbon electrode where the 1st work electrode 7 is called glassy carbon, the carbon material which sintered the plastic foam called PFC at 1000 ** - 2000 **, Or it comprises a thin film which carried out vacuum evaporation or sputtering and formed gold, and the proton attack layer 12 is formed in the surface. The proton attack layer 12 is what dried the solvent and fixed the pre proton attack substance after mercapto-izing or spreading, and it does not stop at combining with the proton (H+) which dissociated from acid, but has the operation which attacks and draws out the proton in the state which constitutes acid where it does not dissociate. Although there are a quinone compound, an azo compound, etc. in this pre proton attack substance, the operation which draws out a proton in the state where these were set to rest potential does not have ****. Namely, if a sample solution is dropped, since will be in the state where the pre proton attack substance which constitutes it anion-ized, acid polarizes with impressed electromotive force, the proton

side becomes delta+ and this proton attack layer 12 has + potential, it will draw out the proton in acid, but. It is because this does not happen in rest potential. Although connected with the pattern 10 for the 1st work electrode, not constituting from another material which was described above, but really forming with energization nature carbon paste together with the pattern 10 for the 1st work electrode can also simplify a manufacturing process, and it is preferred. As a quinone compound, there are a derivative of p-benzoquinone, o-benzoquinone, diphenoquinone, a naphthoquinone, anthraquinone, benzeneazohydroquinone, and also these quinone, etc. The mercapto-ized mercapto quinone compound is preferred. To an azo compound, azobenzene, azophenol, benzeneazomethane, There are benzeneazoethane, azonaphthalene, azotoluene, azobenzoic acid, azoaniline, azoanisole methylazobenzene, 1-benzeneazonaphthalene, benzeneazonaphthol, oxyazobenzene, 2, and 4-dioxyazobenzene etc. o-benzoquinone derivative is used, and the side chain portion was mercapto-ized and has combined the pre proton attack substance of this Embodiment 1 with the 1st work electrode 7.

[0039]The reference electrode 8 generates the potential used as a standard, in order to impress the predetermined reduction potential which returns fatty acid to the 1st work electrode 7, and it comprises a carbon electrode called gold, carbon, and glassy carbon and a carbon material which sintered the plastic foam called PFC at 1000 ** - 2000 **. This reference electrode 8 is connected with the pattern 11 for reference electrodes. It is preferred like the pattern 10 for the 1st work electrode to really form and to make from energization nature carbon paste.

[0040]In parallel with the longitudinal direction of the measuring electrode 1, the pattern 11 for reference electrodes, the pattern 9 for the 1st counter electrode, and the three patterns 10 for the 1st work electrode meet, are formed in this order, and are connected with the 1st counter electrode 6, the 1st work electrode 7, and the reference electrode 8 near the sample injected hole 4, respectively. Portions other than the portion linked to the portion in which each electrode is formed, and a connector, i.e., the surface of each pattern, are covered with the insulating material.

[0041]Next, the lactic acid primary detecting element B of the measuring electrode 1 is explained.

[0042]Since 13 constitutes the lactic acid primary detecting element B, similarly 14 is the 2nd work electrode the 2nd counter electrode. The 2nd work electrode 14 is formed in

rectangular shape in this Embodiment 1, and the 2nd counter electrode 13 is carrying out the circle configuration which opened the opening of rectangular shape in the inside. The 2nd work electrode 14 puts prescribed clearance on mosaic shape, is accommodated in the opening of the 2nd counter electrode 13, and it is together put so that it may become a circle configuration as a whole.

[0043]15 is the pattern for the 2nd counter electrode which printed thinly the energization nature carbon paste which made the substrate 1a contain a resin binder by screen-stencil to band-like, in order to thin-film-ize the lactic acid primary detecting element B and to form it. 16 is the pattern for the 2nd work electrode which similarly printed and formed energization nature carbon paste in band-like thinly for lactic acid primary detecting element B formation. When a sample is dropped, 17 is a buffer layer which severs the influence of both reactions, in order to measure lactic acid after separating the reaction generated in the total-fatty-acid primary detecting element A and the lactic acid primary detecting element B for measurement and detecting total fatty acid. If specified time elapse is carried out, the buffer layer 17 will be chosen so that a sample solution may permeate. The material is gel material, such as acetic acid methyl cellulose and agar. Thickness and material are determined by into how much time penetration time is made. 18 is a reaction layer which consists of enzymes, such as lactic acid oxidase required in order to oxidize L-lactic acid to pyruvic acid, and is formed via the electron carrier explained to be hydrophilic giant molecules below on the thin film of the 2nd work electrode 14 and the 2nd counter electrode 13. If D-lactic acid is mixed with the lactic acid racemase which carries out racemization to L-lactic acid, it can be made to change to pyruvic acid, no matter it may be what lactic acid although lactic acid also includes D-lactic acid. In addition, an phosphate is mixed by the reaction layer 18. As hydrophilic giant molecules, the polymers of an alkylene oxide system are suitable and ferrocene, potassium ferricyanide, and benzoquinone are suitable for an electron carrier. Sulfone sodium p-benzoquinone is used in this Embodiment 1. They may be other water-soluble benzoquinones and a further water-soluble quinone compound.

[0044]If the oxidation potential of lactic acid is impressed to the lactic acid primary detecting element B, a proton will be taken by above enzymes and electron carriers, lactic acid will oxidize to pyruvic acid, and, as for an enzyme, an active center will change from an oxidation type to a reduction

type. The enzyme of this reduction type reacts to the electron carrier of an oxidation type, and it returns to the enzyme of an oxidation type again, and further, an electron carrier emits electrons from an oxidation type, and returns to a reduction type. When lactic acid oxidase and a lactic acid racemase are used as an enzyme and sulfone sodium p-benzoquinone is used as an electron carrier like this Embodiment 1, it changes from sulfone sodium p-benzoquinone to sulfone sodium p-hydroxybenzoquinone. Since the oxidation current which flows when oxidizing from hydroxybenzoquinone to benzoquinone is proportional to the amount of lactic acid contained in a sample solution, lactic acid of a sample solution can be measured by measuring this oxidation current.

[0045]Although the 2nd counter electrode 13 comprises platinum, black lead, gold, stainless steel, and other conductive materials and it is connected with the above-mentioned pattern 15 for the 2nd counter electrode, it is good not to constitute from the pattern 15 for the 2nd counter electrode, and another material, but to really form with energization nature carbon paste together with the pattern 15 for the 2nd counter electrode. Although the 2nd work electrode 14 is similarly constituted from platinum, black lead, gold, stainless steel, and other conductive materials and is connected with the 2nd work electrode 14, it is good to really form with energization nature carbon paste together with the pattern 16 for the 2nd work electrode.

[0046]The pattern 15 for the 2nd counter electrode, and the pattern 16 for the 2nd work electrode, It meets in parallel with the longitudinal direction of the measuring electrode 1 in order of the pattern 9 for the 1st counter electrode, the pattern 10 for the 1st work electrode, the pattern 15 for the 2nd counter electrode, the pattern 16 for the 2nd work electrode, and the pattern 11 for reference electrodes, is formed, and is connected with the 2nd counter electrode 13 and the 2nd work electrode 14 near the sample injected hole 4, respectively. Since the end of the measuring electrode 1 is inserted in the electrode insertion connector (not shown) of the ulcerousness large intestine disease measuring device mentioned later, the end of each electrode pattern may be crooked near an end.

[0047]Thus, if the measuring electrode of this Embodiment 1 is inserted in the electrode insertion connector of an ulcerousness large intestine disease measuring device and a sample solution is dropped from on the data injected hole 4, through communicating grooves, a sample solution will be

made into the sample holding chamber of two each of the total-fatty-acid primary detecting element A in the measuring electrode 1, and the lactic acid primary detecting element B for 2 minutes, and will be led to it. Since the buffer layer 17 is prepared for the lactic acid primary detecting element B, osmosis into the lactic acid primary detecting element B of a sample solution is overdue, both separation is performed, and after the total-fatty-acid detection by the total-fatty-acid primary detecting element A is completed, lactic acid detection can be performed.

[0048]Detection of total fatty acid is performed as follows. If voltage is impressed between the 1st counter electrode 6 and the 1st work electrode 7 so that it may become the reduction potential of fatty acid about the potential of the 1st work electrode 7, in view of the reference potential which the reference electrode 8 generates, After the sample solution has trickled, a pre proton attack substance carries out proton attack materialization, a proton is taken from fatty acid, and reduction current flows. Although the short chain fatty acid produced by the ulcerousness large intestine disease within the large intestine is carboxylic acid to the carbon numbers 6, such as acetic acid, propionic acid, butanoic acid, valeryl acid, and lactic acid, The reduction potential of these carboxylic acid can measure the concentration of the total fatty acid produced in a body, if the reduction potential of the neighborhood and this neighborhood is impressed comparatively.

[0049]Two typical different methods are one of the methods of impression of the voltage applied between the 1st counter electrode 6 and the 1st work electrode 7. One is the method of sweeping the potential of the 1st work electrode 7 in +800mV--1000mV to the reference electrode 8. This method is called a voltammetry. The explanatory view of a pre peak which appears when drawing 5 (a) performs a voltammetry, and drawing 5 (b) are the related figures of a reduction current value and fatty acid concentration. As shown in drawing 5, the pre peak value of the reduction current which appears in a potential-reduction current curve (voltamogram) when it sweeps is measured, and the concentration of fatty acid is measured using being proportional to the total amount concentration of fatty acid with this pre peak value. in addition -- as a sweep rate -- an electrode reaction -- an electronic transition -- since it is rate-limiting, it is appropriate to consider it as 10 mV/s - 200 mV/s.

[0050]The 2nd measuring method is methods of impressing the reduction potential of short chain fatty acid of the range

of +100mV--600mV to pulse form or step form for the potential of the 1st work electrode 7 to the reference electrode 8. However, when the 1st work electrode 7 is an illustrated above-mentioned material and a different material, there is some change. This method is called chronoamperometry. Drawing 6 is an explanatory view of faradaic current which appears when chronoamperometry is performed. If an electric double layer is formed on the 1st work electrode 7 as shown in drawing 6, a pre proton attack substance will be anion-ized, will turn into a proton attack substance, and will take a proton from short chain fatty acid. In this Embodiment 1, since o-benzoquinone derivative is used, it is returned by electron transfer, and it hydronalium-izes and becomes o-hydroxy benzoquinone derivative. Although the reduction current which flows rapidly at this time is called faradaic current, it measures this faradaic current value and measures the total concentration of short chain fatty acid.

[0051]Next, lactic acid detection is performed as follows. Lactic acid detection is delayed until the total-fatty-acid primary detecting element A finishes measurement, since the buffer layer 17 exists. When the oxidation potential of lactic acid is impressed between the 2nd counter electrode 13 and the 2nd work electrode 14 after predetermined time progress by the control section of the ulcerousness large intestine disease measuring device later mentioned as Embodiment 3, lactic acid, A proton is taken by the sulfone sodium p-benzoquinone which is an enzyme and an electron carrier, it oxidizes to pyruvic acid, and, as for an enzyme, an active center changes from an oxidation type to a reduction type. The enzyme of this reduction type reacts to sulfone sodium p-benzoquinone, and it returns to the enzyme of an oxidation type again, and sulfone sodium p-benzoquinone receives an electron, turns into sulfone sodium p-hydroxybenzoquinone, and returns to a quinone object by an electrode further. Since the oxidation current which flows at this time is proportional to the amount of lactic acid contained in a sample solution, lactic acid of a sample solution can be measured by measuring this oxidation current.

[0052]Thus, the measuring electrode 1 of this Embodiment 1 can detect the total-fatty-acid concentration and lactic acid concentration of short chain fatty acid easily by dropping a sample solution at the sample injected hole 4. becoming a big difference, if both balance can be seen by this and the ratio of (lactic acid concentration / short-chain-fatty-acid concentration) is calculated by the patient and healthy

person of an ulcerousness large intestine disease -- accuracy -- an ulcerousness large intestine disease can be discovered highly. Since it is electrochemical measurement, a sample can measure at least, and it can detect promptly. If low [in the case of a chronic disease like a hemorrhoids wax, there is bleeding, but (lactic acid concentration / short-chain-fatty-acid concentration)], it is a mere hemorrhoids wax and will not be an ulcerousness large intestine disease.

[0053](Embodiment 2) The substrate A front view which disassembled the ulcerousness large intestine disease measuring electrode [in / in drawing 3 (a) / the embodiment of the invention 2], drawing 3 (b) -- an embodiment of the invention -- the spacer front view which disassembled the ulcerousness large intestine disease measuring electrode which can be set, the substrate B front view with which drawing 3 (c) disassembled the ulcerousness large intestine disease measuring electrode in the embodiment of the invention 2, and drawing 4 are the sectional views of the ulcerousness large intestine disease measuring electrode in the embodiment of the invention 2 two. The reaction and the operation are the same as that of Embodiment 1 fundamentally, and detailed explanation is yielded to Embodiment 1 and omitted here.

[0054]The substrate A which constitutes the total-fatty-acid primary detecting element A of the measuring electrode 1 in which 1'a consists of insulating materials, such as polyethylene terephthalate, in drawing 3 and drawing 4. The substrate B which constitutes the lactic acid primary detecting element B of the measuring electrode 1 in which 1'b similarly consists of insulating materials, and 3 are the monotonous spacers with which the opening which was formed. [a sample can be poured into the measuring electrode 1] [communicating grooves and] [a liquid pool] It is a sample injected hole which 19 is formed in the spacer 3 and distributes a sample to the both sides of the total-fatty-acid primary detecting element A and the lactic acid primary detecting element B, and 20 is an opening for sample holding chamber formation used as eye a liquid pool the sample injected hole 19 was connected with. A sample is made like Embodiment 1.

[0055]Here, the total-fatty-acid primary detecting element A of the measuring electrode 1 of Embodiment 2 is explained. Since 21 constitutes the total-fatty-acid primary detecting element A, the 1st counter electrode, similarly, 22 is the 1st work electrode and 23 is a reference electrode. It is formed in rectangular shape also in this Embodiment 2, the 2nd

counter electrode 21 puts prescribed clearance on mosaic shape, and accommodates these two in a crevice, and the 1st work electrode 22 and the reference electrode 23 are together put so that it may become approximately rectangular shape as a whole.

[0056]24 is the pattern for the 1st counter electrode which printed thinly the energization nature carbon paste which made substrate 1'a contain a resin binder by screen-stencil to band-like, in order to thin-film-ize the total-fatty-acid primary detecting element A and to form it. Similarly the pattern for the 1st work electrode which 25 similarly printed energization nature carbon paste to band-like thinly for total-fatty-acid primary detecting element A formation, and was formed, and 26 are the patterns for reference electrodes. 12 is a proton attack layer for drawing out a proton from fatty acid of a sample, returning with the 1st work electrode 22, and forming the pre peak of fatty acid.

[0057]The 1st counter electrode 21, the 1st work electrode 22, and the reference electrode 23 are the same as that of what was explained by Embodiment 1.

[0058]In parallel with the longitudinal direction of the measuring electrode 1, the pattern 26 for reference electrodes, the pattern 24 for the 1st counter electrode, and the three patterns 25 for the 1st work electrode meet, are formed in this order, and are connected with the 1st counter electrode 21, the 1st work electrode 23, and the reference electrode 23 near the sample injected hole 19, respectively.

[0059]Next, the lactic acid primary detecting element B of the measuring electrode 1 of Embodiment 2 is explained.

[0060]Since 27 constitutes the lactic acid primary detecting element B, similarly 28 is the 2nd work electrode the 2nd counter electrode.

[0061]The 2nd work electrode 28 is formed in rectangular shape also in this Embodiment 2, and the 2nd counter electrode 27 is carrying out the circle configuration which opened the opening of rectangular shape in the inside. The 2nd work electrode 28 puts prescribed clearance on mosaic shape, is accommodated in the opening of the 2nd counter electrode 27, and it is together put so that it may become a circle configuration as a whole.

[0062]29 is the pattern for the 2nd counter electrode which printed thinly the energization nature carbon paste which made substrate 1'b contain a resin binder by screen-stencil to band-like, in order to thin-film-ize the lactic acid primary detecting element B and to form it. 30 is the pattern for the 2nd work electrode which similarly printed and formed energization nature carbon paste in band-like thinly for

lactic acid primary detecting element B formation. 17 is the same buffer layer as Embodiment 1. 18 is a reaction layer which consists of the same enzyme as Embodiment 1.

[0063]The pattern 29 for the 2nd counter electrode and the pattern 25 for the 2nd work electrode meet in parallel with the longitudinal direction of the measuring electrode 1, and are formed. The lactic acid primary detecting element B is a position of the opening 20 for sample holding chamber formation formed in the spacer 3, counters with the total-fatty-acid primary detecting element A of substrate A1'a, and is laminated on both sides of the spacer 3.

[0064]Thus, besides the operation effect which the measuring electrode 1 of Embodiment 1 does so since the measuring electrode of this Embodiment 2 is constituted, What is necessary is to print the total-fatty-acid primary detecting element A and the lactic acid primary detecting element B to each of two substrates, and just to form in it, and arrangement of an electrode or a circuit pattern is simple, and since the number of the openings for sample holding chamber formation may be one, the composition of a spacer also becomes easy.

[0065](Embodiment 3) Drawing 7 is a perspective view of the ulcerousness large intestine disease measuring device of the embodiment of the invention 3, and drawing 8 is a control circuit figure of the ulcerousness large intestine disease measuring device of this Embodiment 3 of this invention.

[0066]The start stop button for starting the measurement in which 31 was allocated in by the ulcerousness large intestine disease measuring device body, and 32 was allocated by the upper surface of the ulcerousness large intestine disease measuring device 31 in drawing 7, KONEKU for the power button to which 33 carries out ON OFF of the power supply of the ulcerousness large intestine disease measuring device 31, and 34 to insert the measuring electrode 1 which detects an ulcer disease, and connect it to an internal control circuit, When 35 displays the ratio of (the lactic acid concentration / short-chain-fatty-acid concentration) of a sample and this ratio is over the predetermined threshold, it is LCD (displaying means) which indicates that there is possibility of an ulcer disease.

[0067]With the control for 36 being a control section, having the timer and the memory in drawing 8, and giving predetermined potential to each electrode of the measuring electrode 1. Lactic acid concentration and short-chain-fatty-acid concentration are computed from the current value equivalent to lactic acid concentration and short-chain-fatty-

acid concentration, or the ratio of (lactic acid concentration / short-chain-fatty-acid concentration) is calculated, and LCD is controlled further. If the start stop button 32 and the power button 33 are pushed, the control section 36 will turn on a corresponding switch and operation of it will be attained. And if the control section 36 orders it a start, when a timer will start a count and it will carry out the count-out of the detection of total-fatty-acid concentration, it orders so that lactic acid may be detected. The D/A converter which changes data for 37 to impress predetermined potential to a reference electrode, the 1st counter electrode, and the 2nd counter electrode into an analog signal, An operational amplifier for 38 to impress predetermined potential to the 1st counter electrode or the 2nd counter electrode, the relay whose 39 changes the output by the side of a reference electrode and a counter electrode, and 40 are relays which change the output to the 1st counter electrode and the 2nd counter electrode. The D/A converter which changes data for 41 to impress predetermined potential to the 1st work electrode and the 2nd work electrode into an analog signal, Resistance for an operational amplifier for 43 to impress predetermined potential to the 1st work electrode or the 2nd work electrode and 44 to measure the current which flows between the 1st work electrode, between the 1st counter electrode and the 2nd work electrode, and the 2nd counter electrode, and 45 are the relays for changing the 1st work electrode and the 2nd work electrode. The voltage amplification part which the voltage of the both ends of the resistance 44 is inputted into 46, and breaks drop voltage by resistance, amplifies it and outputs it, and 47 are A/D converters which data-ize drop voltage amplified in the voltage amplification part 46, and are inputted into a control section. The control section 36 memorizes this data in an internal memory as a current value which flows between the 1st work electrode, between the 1st counter electrode and the 2nd work electrode, and the 2nd counter electrode.

[0068]Next, the control circuit of this Embodiment 3 explains how it operates. If the measuring electrode 1 is inserted in the connector 34, a sample solution is dropped at the sample injected hole 4 and the start stop button 32 and the power button 33 are pushed, the control section 36 which built in the microcomputer will turn on a corresponding switch, and operation of it will be attained. connecting the relay 39 to the B contact side, and connecting the relay 40 to the A' point-of-contact side, in order to energize the control section 36 to the 1st counter electrode, the 1st work electrode, and reference electrode

which constitute the total-fatty-acid primary detecting element A in order to start a time check with a counter and to detect fatty acid in response -- the relay 45 -- A" -- it connects with a side. Then, the data of a reference electrode is read from a memory, is analog-ized with D/A converter 37, and the control section 36 inputs it into the operational amplifier 38. The operational amplifier 38 controls the potential of the 1st counter electrode to become reference voltage about a reference electrode using imaginary short as data. The data of the 1st work electrode is read from a memory, is analog-ized with a D/A converter, and the control section 36 inputs it into the operational amplifier 43. A voltage drop happens by the resistance 44 for detecting current, and the operational amplifier 43 serves as HOROA in order to prevent change from appearing in the potential of the 1st work electrode of an output side. Thereby, the 1st work electrode is controlled by predetermined potential as data.

[0069]In order to detect short chain fatty acid, when sweeping with a voltammetry, the control section 36 sweeps the potential of the 1st work electrode the sweep rate of 10 mV/s - 200 mV/s, and in +800mV--1000mV. When the 1st work electrode is based on the potential of a reference electrode, potential which turns into predetermined potential to sweep is impressed to the 1st counter electrode by the imaginary short of the operational amplifier 38. After the reduction current value which flows through the 1st work electrode at this time is detected by the voltage drop by the resistance 44 and amplifying it in the voltage amplification part 46, it is data-ized via A/D converter 47, and is inputted into the control section 36. In the data which constitutes a voltamogram in the data of a current value, the control section 36 chooses and carries out the memory of the data used as a pre peak value. This data is proportional to short chain total-fatty-acid concentration.

[0070]By the way, short chain fatty acid can also measure the chronoamperometry which sweeps with a voltammetry, and does not quantify in quest of a pre peak, but detects and quantifies the current which impresses predetermined voltage and flows transitionally then. When measuring short chain fatty acid by this chronoamperometry, the control section 36 impresses the voltage of pulse form or step form to the 1st work electrode. The resistance 44 detects the reduction current value which flows through the 1st work electrode at this time, and it data-izes via the voltage amplification part 46 and A/D converter 47, and inputs into the control section 36. The control section 36 chooses and

carries out the memory of the data believed to be faradaic current in the data of a current value. This data is proportional to short chain total-fatty-acid concentration.
[0071]After measuring the amount of fatty acid in the total-fatty-acid primary detecting element A, A point of contact and the relay 40 will be changed to B' point of contact, and the control section 36 will change the relay 45 for the relay 39 to B" point of contact, if a timer carries out a count-out. Since the preset value of the timer is suitably chosen by the material and thickness of the buffer layer 17 of the measuring electrode 1, when a count-out is carried out, the sample solution permeated in the lactic acid primary detecting element B, and has already caused the chemical reaction in the operation of the enzyme of a reaction layer. Subsequently, the data of the 2nd counter electrode is read from a memory, is analog-ized with D/A converter 37, and the control section 36 inputs it into the operational amplifier 38. The 1st counter electrode is controlled to the potential as data via HOROA which the operational amplifier 38 constitutes. The control section 36 reads the data which impresses the oxidation potential of lactic acid to the 2nd work electrode, in order to detect lactic acid, and it impresses the oxidation potential of lactic acid to the 2nd work electrode via HOROA which the operational amplifier 43 constitutes. An oxidation current value is detected by the resistance 44, and the control section 36 makes this data and carries out a memory.
[0072]After current value detection of short chain fatty acid and lactic acid is completed, the control section 36 converts this into short-chain-fatty-acid concentration and lactic acid concentration, and calculates and carries out the memory of the ratio [further / (lactic acid concentration / short-chain-fatty-acid concentration)]. Then, the control section 36 sends and displays these data on LCD.
[0073]Thus, the ulcerousness large intestine disease measuring device of this Embodiment 3, While measuring total fatty acid with a voltammetry in the total-fatty-acid primary detecting element A, The lactic acid generated in an after-measurement reaction layer in short chain fatty acid can be measured in the lactic acid primary detecting element B, and for the pyruvic acid by which it is generated in the case of lactic acid measurement, measurement of the total amount concentration of short chain fatty acid is not put out of order, and since the ratio of lactic acid concentration to total-fatty-acid concentration is computed, an ulcerousness large intestine disease can be judged correctly. Since total fatty acid is measured by chronoamperometry in a total-

fatty-acid primary detecting element, total fatty acid can be correctly measured in a short time without sweeping.
[0074]Since the enzyme reaction of the lactic acid is carried out and short chain fatty acid is selectively measured after measurement with a voltammetry, the concentration of total fatty acid is not out of order from the pull bottle acid by which it is generated in the case of lactic acid measurement. It is the same even when short chain fatty acid is measured by chronoamperometry.
[0075]
[Effect of the Invention]As mentioned above, according to this invention, the following advantageous effects are acquired.
[0076]According to the ulcerousness large intestine disease measuring electrode indicated to claim 1, by impressing voltage to a total-fatty-acid primary detecting element and a lactic acid primary detecting element, respectively, After carrying out deprotonate by a proton attack substance and measuring total-fatty-acid concentration electrochemically, the lactic acid concentration generated by the enzyme reaction in the reaction layer which reached behind time by the buffer layer can be measured.
[0077]According to the ulcerousness large intestine disease measuring electrode indicated to claim 2, even if the enzyme which can oxidize lactic acid specifically is only L-lactic acid, racemization of the D-lactic acid is carried out and the total amount concentration of lactic acid can be measured correctly.
[0078]According to the ulcerousness large intestine disease measuring electrode indicated to claim 3, it is hard to dissolve blood and the immobilization to an electrode is easy.
[0079]According to the ulcerousness large intestine disease measuring electrode indicated to claim 4, fixed power becomes strong.
[0080]According to the ulcerousness large intestine disease measuring electrode indicated to claim 5, it is compact and carrying is easy.
[0081]According to the ulcerousness large intestine disease measuring electrode indicated to claim 6, each electrode is flattened, it can do compactly thinly, and production is also easy.
[0082]While measuring total fatty acid with a voltammetry in a total-fatty-acid primary detecting element according to the ulcerousness large intestine disease measuring device indicated to claim 7, The lactic acid generated in an after-measurement reaction layer in total fatty acid can be

measured in a lactic acid primary detecting element, measurement of the total amount of total fatty acid is not put out of order for the pyruvic acid by which it is generated in the case of lactic acid measurement, and since the ratio of lactic acid concentration to total-fatty-acid concentration is computed, an ulcerousness large intestine disease can be judged correctly.

[0083]While measuring total fatty acid by chronoamperometry in a total-fatty-acid primary detecting element according to the ulcerousness large intestine disease measuring device indicated to claim 8, Since measurement of the total amount of total fatty acid is not put out of order and the ratio of lactic acid concentration to total-fatty-acid concentration is computed for the pyruvic acid which generates the lactic acid generated in an after-measurement reaction layer in total fatty acid in a lactic acid primary detecting element in the case of lactic acid measurement, an ulcerousness large intestine disease can be judged correctly.

[0084]Since according to the ulcerousness large intestine disease judging method indicated to claim 9 the enzyme reaction of the lactic acid is carried out and total fatty acid is selectively measured after measurement with a voltammetry, the concentration of total fatty acid is not out of order for the pyruvic acid by which it is generated in the case of lactic acid measurement.

[0085]It is indicated to claim 10, and since according to the ulcerousness large intestine disease judging method the enzyme reaction of the lactic acid is carried out and total fatty acid is selectively measured after measurement by chronoamperometry, the concentration of total fatty acid is not out of order for the pyruvic acid by which it is generated in the case of lactic acid measurement.

[Translation done.]